Oponentský posudek doktorské disertační práce

Opponent's review of doctoral thesis

Nicholas Philip Talbot, MSc.

„A detailed study on aerosol particle distribution in indoor and outdoor environment with attention to ammonium nitrate transformations."

Mr. Nicholas Philip Talbot has submitted his doctoral thesis for a defense in the field of study Environmental sciences at the Charles university in Prague. The study targets the subject of indoor air quality, namely, the particulate matter, which is considered to be one of the primary air quality related problems, with a major impact on human well being and health. The thesis addresses experimental methods of measurement of particulate matter in the ambient air, the fate and transformations of ammonium nitrate particles, and the fate of the particles in the outside air as they penetrate indoors. The topic falls well within the field of Environmental sciences, and is of current scientific as well as public interest.

The thesis consists of a well-written and logical introduction into the subject, definition of gaps in the current state of knowledge, and five published or to-be-published peer-reviewed journal articles. The first article addresses various transformation (formation, dissociation, transitions between liquid and solid states) of ammonium nitrate. Second and third articles deal with experimental investigation of indoor aerosols as a function of outdoor aerosols. These three articles, in all three Mr. Talbot being the first author, describe a comprehensive set of mutually complimentary experiments. The fourth article compares different types of impactors, used for collection of size-resolved particulate matter, typically for quantitative gravimetric and chemical analysis. The fifth article is a rather novel investigation of particulate matter in the Prague subway. In the fourth and fifth articles, Mr. Talbot is the second author.

The experimental work presented here was done at the Institute of Chemical Processes of the Czech Academy of Sciences, the best equipped particle measurement laboratory in the country both in terms of excellent staff and a battery of sophisticated analytical equipment. The identification of the goals of the experiments, their design, choice of instruments, and test execution were excellent and are well and logically described. Attention is paid to many details, each of which, if not properly addressed, could have been detrimental to the study. This attention to detail demonstrates the wealth of knowledge and experience gained by the author. The data analysis is sound, with proper, educated and well-chosen use of statistics. The conclusions are supported by the data and sound.

The discussions in the first three articles speak of the depth of knowledge of Mr. Talbot, while the experimental setup, and the last two articles, demonstrate the breath of knowledge and experience he has encompassed.

The work presents new findings which are important for future work in the field, and contains a wealth of guidance as to the measurement of inorganic aerosols.

The structure of the thesis, the format and the total length of 173 pages of text, along with over two hundreds references, are appropriate.

The shortcomings of the thesis are minor, of such nature that they would likely obtain a „publish with minor amendments" rating from a journal reviewer. For example, some citations are not uniform (Guo vs. Hai Guo, p. 44), some are ambigous (p. 49 - two works Hussein 2006), some references are not cited (Riley, p. 50), ammonia measurement is not described in an otherwise well written Experimental section (p. 69), radiative forcing of black carbon is omitted (chapter 2), the share of anthropogenic particulate matter is 2.5% in ch. 1.3. and 10% in ch. 3.1., and there are some typographical errors and „orphans" (chapter title being the last line on the page, figure separated from its caption, etc.). None of these issues have any practical effect on the comprehension of the work by the reader or on the validity of the work.

Overall, I consider the thesis of Mr. Nicholas Philip Talbot to be of excellent quality, with very minor shortcomings, and I recommend that he is admitted to defend his work in front of the doctoral examination committee.

I suggest that the following questions will be answered by the author:

- In the first article, you suggest that the 200 nm ammonium nitrate particles fully evaporate/dissociate faster than 50 nm or 100 nm particles. One could argue that if the dissociation takes place on the surface, a 200 nm particle first becomes a 100 nm particle, then a 50 nm particle, and so on. How would you explain the faster dissociation of the 200 nm particle?
- You also claim that longer residence time of the particle in the reactor leads to faster rate of dissociation. How was the rate of dissociation measured or calculated, and what assumptions were made? Does the dissociation rate gradually increase with residence time, and why?
- Are the findings in the first three articles about transformation of aerosol during its way from outdoors to indoors applicable to the measurement in Prague subway?
- The measurements in Prague subway took place at the Muzeum station, which is directly above a major urban highway, and next to the Prague main railway station. Were the ultrafine particles from vehicular traffic scavenged by the larger iron particles? Could some of the iron particles have originated from the trains many of which still heavily rely on cast iron friction brakes, while subway cars use mostly electrodynamic braking and rely on friction brakes typically only at low speeds?

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